UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The United States Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) for the aquatic life (benthic) use impairment on the Clinch River. The TMDL was submitted to EPA for review in April 2004. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address an impairment of water quality as identified in Virginia's 1998, Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDL for the aquatic life use impairment on the Clinch River satisfies each of these requirements.

Following the approval of the TMDL, Virginia shall incorporate the TMDL into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Peter Gold at (215) 814-5236.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

Decision Rationale

Total Maximum Daily Loads for
the Aquatic Life Use Impairment on the Clinch River

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use (benthic) impairment on the Clinch River. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Clinch River Watershed is located in Tazwell County, Virginia and is part of Tennessee Big Sandy River Basin. The impaired segment runs 5.5 miles from the Clinch River's confluence with Licolnshire Branch downstream to its confluence with Plum Creek. The 30,611-acre watershed is rural with forested (51 percent) and agricultural (44 percent) lands making up 95 percent of the watershed area. The remainder of the watershed is split between developed (over 3 percent), wetlands (1 percent), and transitional lands (1 percent).

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed the Clinch River (VAS-P01R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard for the aquatic life use. This decision rationale will address the TMDL for the impairment of the general standard for the aquatic life use. The failure to attain this use was determined through biological assessments of the benthic

macroinvertebrate community.

Virginia's 305(b)/303(d) guidance states that support of the aquatic life beneficial use is determined by the assessment of conventional pollutants (dissolved oxygen (DO), pH, and temperature); toxic pollutants in the water column, fish tissue, and sediments; and biological evaluation of benthic community data.[1] Therefore, a biological assessment of the benthic community can be used to determine a stream's compliance with the state's general standard for the aquatic life use. Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.[2] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[3] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters for TMDL development. During the 1998 assessment period, the Clinch River was identified as being moderately impaired. Current analysis using the SCI approach demonstrates that the Clinch River contains a minimally impaired benthic community. The Commonwealth intends to list streams that score below 62 using the SCI method as impaired. Sampling conducted at the Clinch River indicate its average SCI score would be 58.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. The analysis does not inform the biologist as to what is causing the degradation of the benthic community. Although, further interpretation of biological community can identify likely stressors, additional analysis is required to determine the pollutants which are causing the impairment. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and

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[1]VADEQ. 1997. 1998 Water Quality Assessment Guidance for 305(b) Water Quality Report and 303(d) TMDL Priority List Report. Richmond, VA.

[2]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[3]Ibid 2

water quality criteria.[4] A reference watershed approach was used to determine the stressors and the endpoints for the Clinch River TMDLs. Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the TMDL which will allow the impaired water to attain its designated uses. A reference watershed approach is based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards.

To determine whether a stream was a suitable reference site for the monitored site, the modelers evaluated the topography, soils, ecoregion, landuses, watershed size, and point source inventory of the potential reference site. A reference site candidate was removed if it was identified as moderately or severely impaired in the biomonitoring analysis. The reference site selected for the Clinch River was Walker Creek.

The next step in the TMDL development process was to determine the loadings and stressors in the monitored and reference watersheds. Low DO, sedimentation, habitat modification, nutrients, and toxic pollutants were evaluated as possible stressors to the monitored stream. Ambient water quality monitoring on the Clinch River documented temperature, DO, pH, turbidity, total suspended solids (TSS), nitrogen, and phosphorous.

To get a better understanding of the DO concentrations during the most critical periods, diurnal DO sampling was conducted on September 04, 2002 for the Clinch River. Early morning samples were collected at the Clinch River at the end of the summer season when the lowest DO concentrations are expected to be found due to a combination of high water temperatures (lower solubility of oxygen) and low flows. The diurnal DO data also captures the impacts of respiration from primary producers on the stream system. During the evening and early morning hours, these organisms cease photosynthetic operations since there is no sunlight available and consume oxygen. The early morning period is often the most critical as respirtation has been occurring for a longer period of time. The three samples collected from 5 to 7 a.m. all had DO concentrations above the applicable criteria. As a result of this analysis DO and nutrients were ruled as possible stressors. Nutrients were ruled out since it was believed that the impacts of excessive nutrient loadings would be observed in lower DO concentrations as a result of excess primary production and decay.

Toxicity testing was conducted for water samples collected from the Clinch River. The testing compared the survival and growth rates or fathead minnows (Pimephales promelas) and water fleas (Ceriodaphnia dubia) in water collected from the impaired site with an unimpaired water source. The test did not document any statistically significant effects associated with fathead minnows or water fleas reared in water from the Clinch River. Toxicity was therefore ruled out as a possible stressor to the Clinch River system. It should be noted that elevated levels of polychlorinated biphenyls (PCBs), nickel, and zinc were found sporadically in sediment samples collected from 1993 through 1998. Nickel and zinc were not found above EPA's

[4]Ibid 2

probable effects concentration (PEC) or the National Oceanic and Atmospheric Administration's effects range-median (ER-M) concentrations. These metals are not expected to be impacting the benthic community. However, a single PCB (720 ppb) sample was detected that was above both the PEC level of 676 ppb and the ER-M concentration of 180 ppb. This was the only time PCBs were detected in the sediment of monitoring station 6BCLN339.53 additional sampling may be warranted to confirm the presence of these compounds.

Sediment and habitat degradation were also analyzed as possible stressors to the benthic community. Habitat assessments conducted by Department of Environmental Quality and George Mason University indicated that sediment was a likely stressor. These analyses indicated that intersitial spaces used by benthic organisms for habitat were being blanketed by excess sediment. The embeddedness (extent to which rocks and snags are covered or sunken into the silt, sand or mud of the stream bed) scores for the Clinch River were all low. An evaluation of the RBPII analysis showed that a more sediment tolerant community was residing in the stream and water quality data indicated elevated levels of turbidity and total suspended solids. Therefore sediment was viewed as the most likely stressor to the Clinch River.

The next step in developing the TMDL was to determine the sediment (the stressor) loadings to the monitored and reference segments. The Generalized Watershed Loading Functions (GWLF) model was selected as the means to determine loadings to the streams. The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[5] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. To equate the reference watershed with the monitored watershed, the reference watersheds were decreased in size to that of the impaired watersheds in the model, the landuses were proportionally decreased based on the percent land use distribution. Therefore, the landuse breakdown in the reference watershed remained constant.

Local rainfall and temperature data were needed to simulate the hydrology. The Wytheville weather station was used for the simulation of both the Clinch River and Walker Creek. To insure that the models accurately predicted the stream flow the modeled flow results were compared to the observed flows, a process known as calibration. The models' parameters were adjusted based on these results to insure the most accurate representation of the system. There were United States Geological Survey (USGS) gaging stations in both the Clinch River and Walker Creek Watersheds. USGS gage 03524000 on the Clinch River in Cleveland, Virginia was used for the calibration of the Clinch River. USGS gage 03173000 was used for the calibration of Walker Creek. For the Clinch River the calibration was for April 1991 through September 2002 while Walker Creek was calibrated to a flow record from 1981 through 1999. The simulation closely reflected the observed flows in both watersheds. The results of the

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[5]Ibid 2

[6]Ibid 2

models are documented in Section 5.0 of the report. Table 1 documents the TMDL allocations to the impaired segment.

Table 1 - Summarizes the Sediment Allocations for the Clinch River

Stream	Pollutant	TMDL (lbs/yr)	WLA (lbs/yr)	LA (lbs/yr)	MOS*(lbs/yr)
Clinch River	Sediment	7,580,309	206,636	6,614,615	759,058

* Virginia includes an explicit MOS by reserving the 10 percent of total loading to the MOS.

The United States Fish and Wildlife Service has been provided with copy of the TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing aquatic life use (benthic) impairment TMDL for the Clinch River. EPA is therefore approving this TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

The impaired segment was listed as impaired due to a degradation of its benthic macroinvertebrate community. As mentioned above, benthic assessments inform the biologist of an impairment, but they are unable to identify stressors conclusively. Through a careful analysis of water quality monitoring data, habitat assessments, and the biological community, Virginia determined that excessive levels of sediment are causing the degradation of the benthic community in the Clinch River. The Commonwealth does not have numeric standards for sediment at this time. Therefore, the loading obtained from the reference watershed was used as the endpoint for the TMDL. Its believed that if the Clinch River can reduce its sediment load to that of the area weighted reference watershed, the impairment to the benthic community will be relieved.

The GWLF model was used to determine the loading rates of the stressor (sediment) to the streams from all point and nonpoint sources. The TMDL modelers determined the applicable stressor loading rates within each watershed. Data used in the model was obtained on a wide array of items, including landuses in the area, point sources in the watershed, weather, stream geometry, etc..

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[7] To equate the reference watershed with the monitored watershed, the reference watershed was decreased in size to that of the impaired stream in the model. Each landuse was

[7]Ibid 2

decreased in equal proportion, insuring that the landuse breakdown in the reference watershed remained constant. Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from the Wytheville weather station. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of agricultural land, land slope, soil erodibility, and farming practices used in the area.[8] Parameters within the model account for these conditions and practices. Each stream was modeled to the flows observed at a USGS gages within that watershed. Walker Creek was calibrated to observed data from 1981 through 1999 while the Clinch River was calibrated to observed data from 1991 through 2002. The TMDL is based on the flows and loads from 1991 through 1999 when the modeling efforts overlapped.

EPA believes that using GWLF to model and allocate the sediment loadings to the impaired stream segments will ensure the attainment of the designated uses and water quality standards on the Clinch River. Unlike previous TMDLs, streambank erosion was not quantified in the TMDL because of a lack of data.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of nutrients and sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis since it is the annual loading that impacts the community the greatest.

Waste Load Allocations

Virginia has stated that there are five regulated point sources discharging to the impaired segment. Three of the facilities are municipal treatment systems, one is a stormwater system, and the remaining facility is regulated under a general permit. The three municipal systems are identified in Table 2 and their loading can be determined by multiplying the sediment concentration in their effluent by their daily flow by 365 days after appropriate conversions are made. The general permit's load can be determined in the same manner. The stormwater facility's load is based on the modeled stormwater runoff and its permitted TSS concentration.

EPA regulations require that an approvable TMDL include individual waste load allocations (WLAs) for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore,

[8]Ibid 2

EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table 2 - TSS WLAs for the Clinch River

Facility	Permit Number	Permitted Flow (million gallons per day)	Permitted Concentration (mg/L)	TSS Load (tons/yr)
Glenrae II Mobile Home Park	VA0065676	0.4850	60	0.4021
Tazewell Waste Water Treatment Plant	VA0026298	2.00	30	82.9
Greater Tazwell Water Treatment Plant	VA0053465	0.025	60	2.62
Tazwell County Landfill	VAR051267	0.4639	100	7.74
Bannies Wash Bays	VAG750017	0.001	30	0.0634

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), load allocations (LAs) are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings, VADEQ used the GWLF model to represent the impaired watersheds. The GWLF model is a comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. GWLF uses precipitation data for continuous and storm event simulation to determine total loading to the impaired segments from the various landuses within the watershed. Table 3 provides the LA for all of the nonpoint sources of sediment.

Table 3 - LA for Sediment for the Clinch River

Land Use	LA Sediment (lbs/yr)	Percent Reduction
Forest	223.395	0
Pasture Hay	5,134,583	56

Cropland	978,662	55
Barren/Transitonal/Quarries	60,385	55
Urban	217,590	55

3) The TMDL considers the impacts of background pollution.

The reference watershed approach inherently considers the impact of background pollutants by considering the sediment load from all landuses, including forested lands, within the impaired and reference watersheds.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the impaired segments is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[9]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition when the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period for the reference and monitored watersheds to insure that it accounted for wide range of climatic conditions within the watersheds. The allocations developed in the TMDL will therefore insure that the criteria is attained over a wide range of environmental conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Pollutant loadings also change during the year as vegetation grows making it more difficult for sediments to runoff. Consistent with

[9]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and modifying the soil loss equations based on the time of the year.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia includes an explicit MOS by allocating 10 percent of the total TMDL loading to the MOS.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

The public participation process for theClinch River TMDL commenced on April 10, 2003 with a stakeholder and TMDL study kickoff meeting. There were two public meetings held for the TMDL at the Tazwell Fairgrounds. The first meeting was held on June 23, 2003 from 7 to 10 p.m. the second was held on February 10, 2004 from 7 to 10 p.m. The documents and meetings were all advertised in the Virginia Register and opened to a thirty day comment period.